

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 June 2001 (28.06.2001)

PCT

(10) International Publication Number
WO 01/47080 A1

(51) International Patent Classification⁷: **H02B 1/01**

I-23847 Molteno (IT). ANTONIAZZI, Antonello [IT/IT];
Via Arbe, 29, I-20135 Milano (IT).

(21) International Application Number: PCT/EP00/11243

(22) International Filing Date:
8 November 2000 (08.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
MI99A002674 21 December 1999 (21.12.1999) IT

(71) Applicant (for all designated States except US): **ABB
RICERCA SPA** [IT/IT]; Viale Edison, 50, I-20099 Sesto
San Giovanni (IT).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FONTANA,
Rodolfo** [IT/IT]; Via Monte Generoso, 20, I-21050 Clivio
(IT). **CAGLIANI, Cristian** [IT/IT]; Via de Gasperi, 43,

(74) Agent: **GIAVARINI, Francesco**; ABB Ricerca SpA,
Viale Edison, 50, I-20099 Sesto San Giovanni (IT).

(81) Designated States (*national*): AL, AU, BA, BG, BR, CA,
CN, CZ, HR, HU, IL, IN, JP, KP, KR, MK, MX, NO, PL,
RO, RU, SG, SI, SK, TR, UA, US, YU.

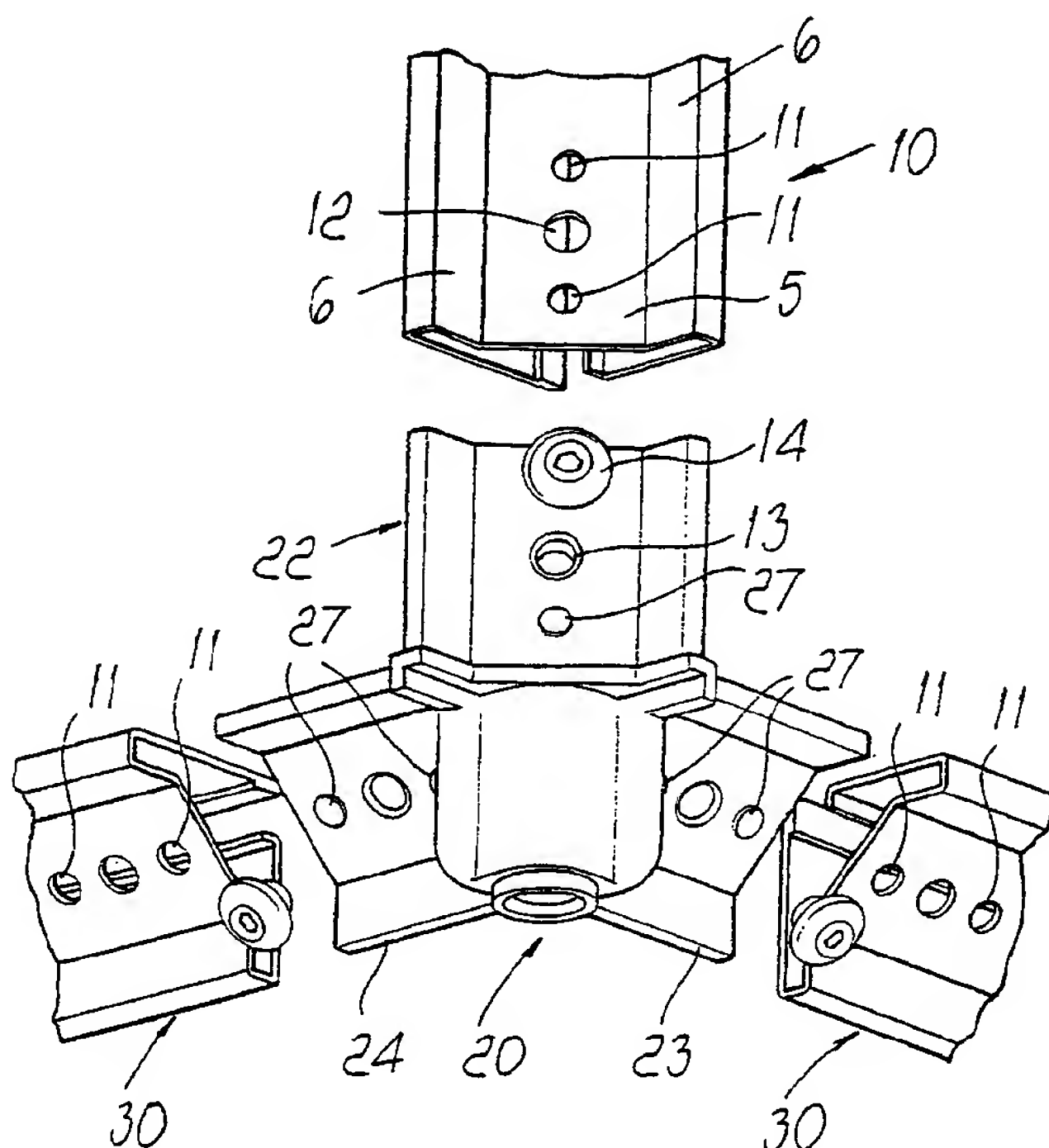
(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,
CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: SUPPORTING FRAME FOR A CABINET OF AN ELECTRICAL PANEL



(57) Abstract: A supporting frame for a cabinet of an electrical panel, comprising at least one first structural element and one second structural element which have a contoured body and are meant to be mutually connected, its particularity consisting of the fact that engagement means suitable to directly facilitate their mutual connection are formed on the contoured body of at least one of the first and second structural elements.

WO 01/47080 A1

SUPPORTING FRAME FOR A CABINET OF AN ELECTRICAL PANEL

DESCRIPTION

The present invention relates to a supporting frame for a cabinet of an electrical panel and to a cabinet which uses said frame; in particular, the present invention
5 relates to a supporting frame for a cabinet of an electrical panel in which the structural elements that constitute the frame are conveniently configured so that their mutual connection occurs directly, according to a solution which stands out owing to its simplicity both in terms of production and in terms of practical use, allowing to facilitate assembly and reduce the costs entailed by its provision.

10 Generally, cabinets for low-voltage electrical panels are specifically designed and built so as to meet the functional and installation requirements of the components that constitute the panel. It is in fact known that electrical panels use a system of mutually parallel metallic bars, each of which is connected to a corresponding polarity of a power supply system. Inside the cabinet, the bars are
15 electrically connected to the devices used in the panel, for example circuit breakers, and are geometrically coupled to appropriate insulation and support devices; said insulation and support devices, in addition to mutually electrically insulating the bars, allow to connect them to the structure of the cabinet. In this manner, any electrodynamic stresses produced by the flow of current in the bars
20 are discharged onto the structure of the cabinet, which accordingly must have adequate structural strength characteristics. Furthermore, the electrical devices are arranged on one or more fixing guides, which are connected to the frame of the cabinet either directly or by using additional connecting elements. In order to meet these requirements, cabinets are generally provided with a structure shaped
25 like a parallelepiped, inside which there is an adequate space suitable to accommodate the components of the panel and whose frame allows the anchoring of the elements that support said components, of the cladding panels and of the door of the cabinet.

In particular, the frame comprises two subframes which respectively constitute the lower and upper bases of the parallelepipedal structure; said subframes are typically constituted by four angular elements, generally known as three-way corner joints, which are mutually connected in pairs by virtue of profiled elements arranged substantially in a horizontal position and commonly known as cross-members. In turn, the subframes are mutually connected by using vertical profiled elements, or uprights, each of which connects two corresponding joints. Holes are furthermore provided along the vertical extension of the uprights for the direct fixing of the supporting elements of the electrical devices and of the distribution bars, or for the fixing of intermediate cross-members to which said supporting elements are connected.

In the current state of the art, the methods by which the various profiled elements of the frame are mutually connected are not fully satisfactory. The connection between the pairs of elements, for example a corner joint and a cross-member or an upright and a joint, in fact occurs by using a plurality of fixing screws, at least two for each coupling, so as to allow adequate connection and correct mutual positioning of the two elements.

These operations, owing to the number of profiled elements used and therefore to the large number of connections to be provided, require long execution times and a large number of fixing screws; furthermore, in view of the stresses, mainly shear stresses, to which the screws are subjected, said screws may break, consequently entailing a technical drawback.

It is also noted that at least two operators are required in order to correctly perform the connections, so that a first operator keeps the elements to be connected in the correct position and the second one actually produces the various connections; accordingly, the assembly and installation costs of the panel increase. Otherwise, i.e., if a single operator works, operations are very time-consuming and difficult to perform.

The aim of the present invention is to provide a supporting frame for a cabinet of an electrical panel in which the connection between the structural elements that constitute the frame occurs in a simplified manner with respect to known solutions, thus facilitating assembly and reducing its time requirements.

- 5 Within the scope of this aim, an object of the present invention is to provide a supporting frame for a cabinet of an electrical panel which is suitable for optimization of the use of the labor required for its production, with a consequent benefit in terms of costs.

Another object of the present invention is to provide a supporting frame for a
10 cabinet of an electrical panel in which, with respect to known solutions, there is a drastic reduction in the additional fixing elements to be used, accordingly reducing the number of the corresponding fixing operations.

Another object of the present invention is to provide a supporting frame for a cabinet of an electrical panel in which there is an optimum distribution of the
15 stresses to which the various connections are subjected, so as to avoid any mechanical failures while ensuring high strength of said connections.

Another object of the present invention is to provide a supporting frame for a cabinet of an electrical panel which is highly reliable, relatively easy to manufacture and at competitive costs.

- 20 This aim, these objects and others which will become apparent hereinafter are achieved by a supporting frame for a cabinet of an electrical panel, comprising at least one first structural element and one second structural element which have a contoured body and are meant to be mutually connected, characterized in that engagement means suitable to directly facilitate their mutual connection are
25 formed on the contoured body of at least one of said first and second structural elements.

The supporting frame according to the invention therefore has the great advantage of comprising elements which are configured so as to integrate direct

engagement means in their structure; with this solution, the connection among the structural elements that constitute the frame occurs without using additional fixing elements, typically screws, with significant advantages in terms of simplicity and speed of assembly and in terms of assembly costs.

5 Further characteristics and advantages of the invention will become apparent from the description of preferred but not exclusive embodiments of the supporting frame according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of a supporting frame for a cabinet of
10 an electrical panel according to a known configuration;

Figure 2 is an exploded perspective view of a corner joint during coupling to an upright and two cross-members according to a preferred embodiment of the supporting frame according to the present invention;

Figure 3 is a perspective view of a detail of the corner joint used in Figure 2;

15 Figure 4 is a schematic perspective view of the engagement means provided on the joint of Figure 3;

Figure 5 is a schematic perspective view of a portion of a joint with engagement means according to a second embodiment of the frame according to the invention.

20 In the description that follows, identical reference numerals designate identical or technically equivalent elements.

Figure 1 illustrates a supporting frame for a cabinet of an electrical panel, generally designated by the reference numeral 100. As shown in said figure, the frame 100 comprises a plurality of profiled elements which are substantially
25 vertical and horizontal and are respectively constituted by uprights 10 and cross-members 30; each profiled element 10 or 30 connects a pair of corner joints 20 so as to provide a frame which is substantially shaped like a parallelepiped.

Advantageously, in the embodiment of the frame according to the invention, in

each pair of structural elements to be connected, for example a joint 20 and an upright 10, or a joint 20 and a cross-member 30, at least one first structural element has a contoured body on which there are engagement means which are suitable to directly facilitate, as described in detail hereinafter, the connection to the second structural element. In particular, the description that follows refers specifically to the connection between a corner joint 20 and an upright 10, but said reference is obviously to be considered merely as an example without intending to limit the scope of application in any way.

An example of a corner joint 20 which can be used in the provision of a frame for a cabinet of an electrical panel is shown in detail in Figure 3; in particular, the joint 20 has a central body 21 which is suitable to be rested on an abutment surface, for example a floor. Three profiled arms, designated by the reference numerals 22, 23 and 24 respectively, protrude from the main body 21 in three directions which are substantially perpendicular to each other; each arm has a substantially flat wall 25 from which two oblique walls 26 protrude in substantially mutually opposite directions, and said arms are suitable to facilitate connection to additional structural elements, for example the upright 10 itself and two cross-members 30.

An embodiment of the upright 10 which can be used in the frame according to the invention is described in detail in European patent application no. 98201165.2, whose description is to be assumed included herein by reference. In particular, as shown in Figure 2, the upright 10 has a substantially flat wall 5 from which two oblique walls 6 protrude in substantially mutually opposite directions; the upright 10 furthermore has a hollow profiled body so as to form a seat which is suitable to accommodate an arm of the corner joint 20.

The corner joint 20 and the upright 10 can both be made of metallic or plastic material according to the various application requirements.

Advantageously, in a preferred embodiment of the frame according to the

invention, on the wall 25 of at least one arm of the joint 20 there is at least one protrusion 27 which protrudes at right angles to said wall 25 and is suitable to engage a corresponding hole 11 formed in the upright 10. As shown in detail in Figure 4, the protrusion 27 is constituted by a body which has a substantially
5 circular cross-section, for example a cylinder, which has a first base surface, which is fixed to the wall 25, and a second end surface 28, which lies opposite the base surface and protrudes substantially along a plane which is inclined with respect to said wall 25. In this manner, the lateral surface 29 that connects the base surface to the end surface 28 partially constitutes an abutment surface for at
10 least one portion of the rim of a hole 11. In particular, in the embodiment of the joint shown in Figures 2 and 3, two protrusions 27 are formed on each wall 25 of the arms 22, 23 and 24, are mutually aligned along the longitudinal extension of the arm and are suitable to engage two corresponding holes 11 formed in the upright 10 and in the cross-members 30. With such a configuration, the stresses
15 that each connection has to withstand, mainly shearing stresses, are distributed along the contact surfaces that form between the walls of the protrusions 27 and the walls of the holes 11.

During assembly, the joint 20 is arranged so as to insert one of its arms, for example the arm 22, in the seat of the upright 10; when the upright 10 is fitted
20 over the arm 22, the inclined surfaces 28 of the two protrusions 27 act as guides for the sliding of the upright and of the corresponding holes 11 until they enter said holes 11. In this situation, the lateral surface 29 of the protrusion, which connects the two end surfaces, acts as abutment element against which at least one portion of the rim of the corresponding hole 11 abuts. Accordingly, each
25 hole 11 is practically engaged with the corresponding protrusion 27 with a solution which prevents the mutual disengagement of the two elements.

In this manner, one has a direct coupling between the structural elements which can be performed by a single operator in a very short time and without using

additional fixing elements, such as for example screws, according to a solution which ensures optimum strength of the connection.

Evidently, the shape and arrangement of the protrusions 27 might be changed according to the various application requirements, for example by providing the protrusions on the upright and the holes in the joint, or by adopting protrusions whose cross-section is other than circular; furthermore, as shown schematically in Figure 2, one might still provide for the use of a hole 12 in the upright and of a seat 13 in the joint in order to use an additional fixing screw 14, for example for security reasons.

10 In an alternative embodiment, shown schematically in Figure 5, at least one arm of the joint 20, for example the arm 22, has a wall 25 with a cutout central portion 35 which is substantially U-shaped; in this case, the engagement means comprise at least one flexible tab 31 which protrudes from the base of the cutout portion 35 in a direction which is substantially parallel to the wall 25. Said flexible tab 31 has an end portion 32 which is shaped so as to facilitate engagement with a corresponding seat formed in the upright 10. In particular, the contoured end 32 comprises a raised portion which has a circular cross-section and has a first base surface which is fixed to the tab 31 and an end surface 33 which lies opposite the base surface and lies substantially on a plane 15 which is inclined with respect to the wall 25, with a shape which is similar to that of the previously described protrusion 27.

The two structural elements are mutually assembled in a manner similar to the one described above, by fitting the upright 10 over the arm of the joint 20, so that the tab 31 flexes toward the wall 25 and facilitates, in cooperation with the inclined surface 33, the sliding of the upright; the opposite end 32 then enters the corresponding seat of the upright and the lateral surface 34 that connects the inclined surface 33 and the base surface which is fixed to the tab 31 acts as abutment for the edge of said seat. The flexibility of the tab 31 furthermore 25

facilitates any uncoupling of the two components. As an alternative, the tab 31 might be shaped differently, for example U-shaped.

The above described solutions may be implemented in an equivalent manner with any component of the frame, for example for the connection between a corner joint 20 and a cross-member 30, in a manner which is fully similar to what has been described for the connection between the joint 20 and the upright 10; in this case, an element whose profile is substantially identical to the profile of the upright 10 can be used as cross-member, as shown in Figure 2. In this manner, it is also possible to have a frame in which the three arms 22, 23 and 24 of a joint 20 are respectively connected to an upright 10, to a first cross-member and to a second cross-member in the manner described above.

In practice it has been found that the frame according to the invention fully achieves the intended aim and objects, since the connection between its structural elements occurs in a simplified manner with respect to the known art, with an optimized use of labor and a consequent benefit in financial terms; furthermore, the possibility to eliminate or at least drastically reduce the use of additional fixing elements allows to further reduce costs and provide faster assembly operations.

Attention is drawn to the fact that all the innovative functions and the inventive aspects of the frame can be obtained according to a solution which is advantageous from the point of view of production; if, for example, the joint is made of metallic material, the protrusion 27 or the tab 31 with the contoured end 32 can be obtained directly during the production of said joint or by performing a simple weld on the body of the joint. If instead the joint is made of plastics, for example by injection-molding, said elements might be formed directly by appropriately shaping the mold. In this case, the adoption of the cutout portion 35 would allow a considerable saving of material.

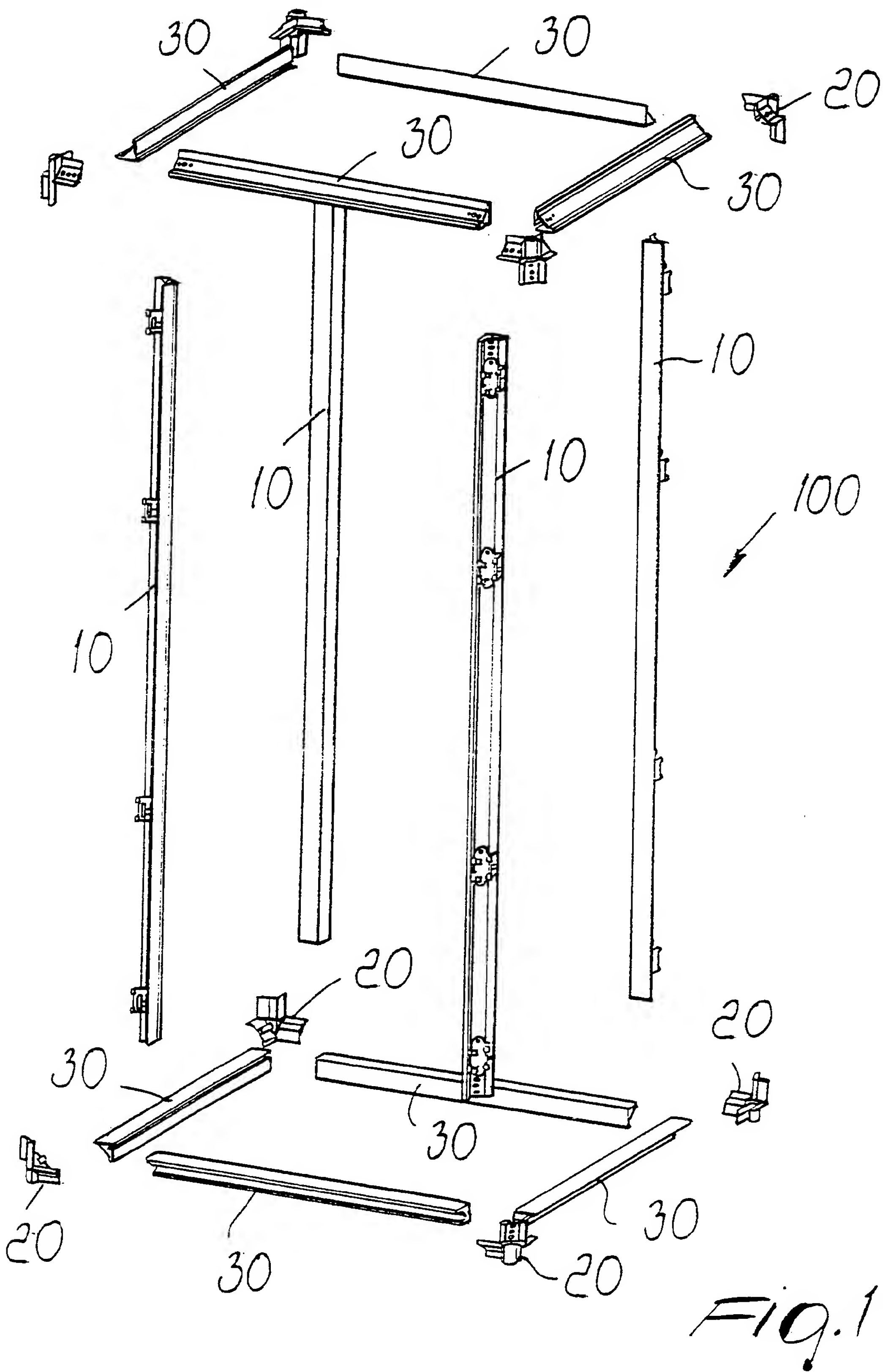
The frame thus conceived is susceptible of numerous modifications and

variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent elements. In practice, the materials used, as well as the dimensions, may be any according to requirements and the state of the art.

CLAIMS

1. A supporting frame for a cabinet of an electrical panel, comprising at least one first structural element and one second structural element which have a contoured body and are meant to be mutually connected, characterized in that engagement means suitable to directly facilitate their mutual connection are formed on the contoured body of at least one of said first and second structural elements.
2. The supporting frame according to claim 1, characterized in that the contoured body of the first structural element has at least one substantially flat wall from which at least one protrusion protrudes transversely, said protrusion being suitable to engage in a hole formed in the second structural element.
3. The supporting frame according to claim 2, characterized in that said protrusion comprises a body which has a substantially circular cross-section and has a first base surface, which is fixed to the flat wall, a second end surface, which lies opposite the base surface substantially on a plane which is inclined with respect to said flat wall, and a third surface for connection between said first and second surfaces which forms an abutment for at least one portion of the rim of said hole.
4. The supporting frame according to claim 3, characterized in that it comprises two protrusions which are suitable to engage in two corresponding holes formed in the second structural element.
5. The supporting frame according to claim 1, characterized in that the contoured body of the first structural element has at least one substantially flat wall which has a central U-shaped cutout portion from the base surface of which at least one flexible tab protrudes in a direction which is substantially parallel to said wall, said tab having an end which is shaped so as to enter a corresponding seat formed in the second structural element.

6. The supporting frame according to claim 5, characterized in that said contoured end has a raised portion which has a substantially circular cross-section, said raised portion having a first base surface which is fixed to the tab, an end surface which lies opposite the base surface substantially on a plane which is inclined with respect to the flat wall, and a third surface which connects said base and end surfaces and acts as abutment for a portion of the edge of said seat.
7. The supporting frame according to one or more of the preceding claims, characterized in that the first structural element is made of plastic monolithically with the engagement means.
8. The supporting frame according to one or more of claims 1 to 6, characterized in that the first structural element is made of metallic material monolithically with the engagement means.
9. The supporting frame according to one or more of claims 1 to 6, characterized in that the first structural element is made of metallic material and the engagement means are welded thereon.
10. The supporting frame according to one or more of the preceding claims, characterized in that the first structural element is a corner joint and the second structural element is an upright.
11. The supporting frame according to one or more of the preceding claims, characterized in that the first structural element is a corner joint and the second structural element is a cross-member.
12. A cabinet of an electrical panel, characterized in that it comprises a supporting frame according to one or more of the preceding claims.



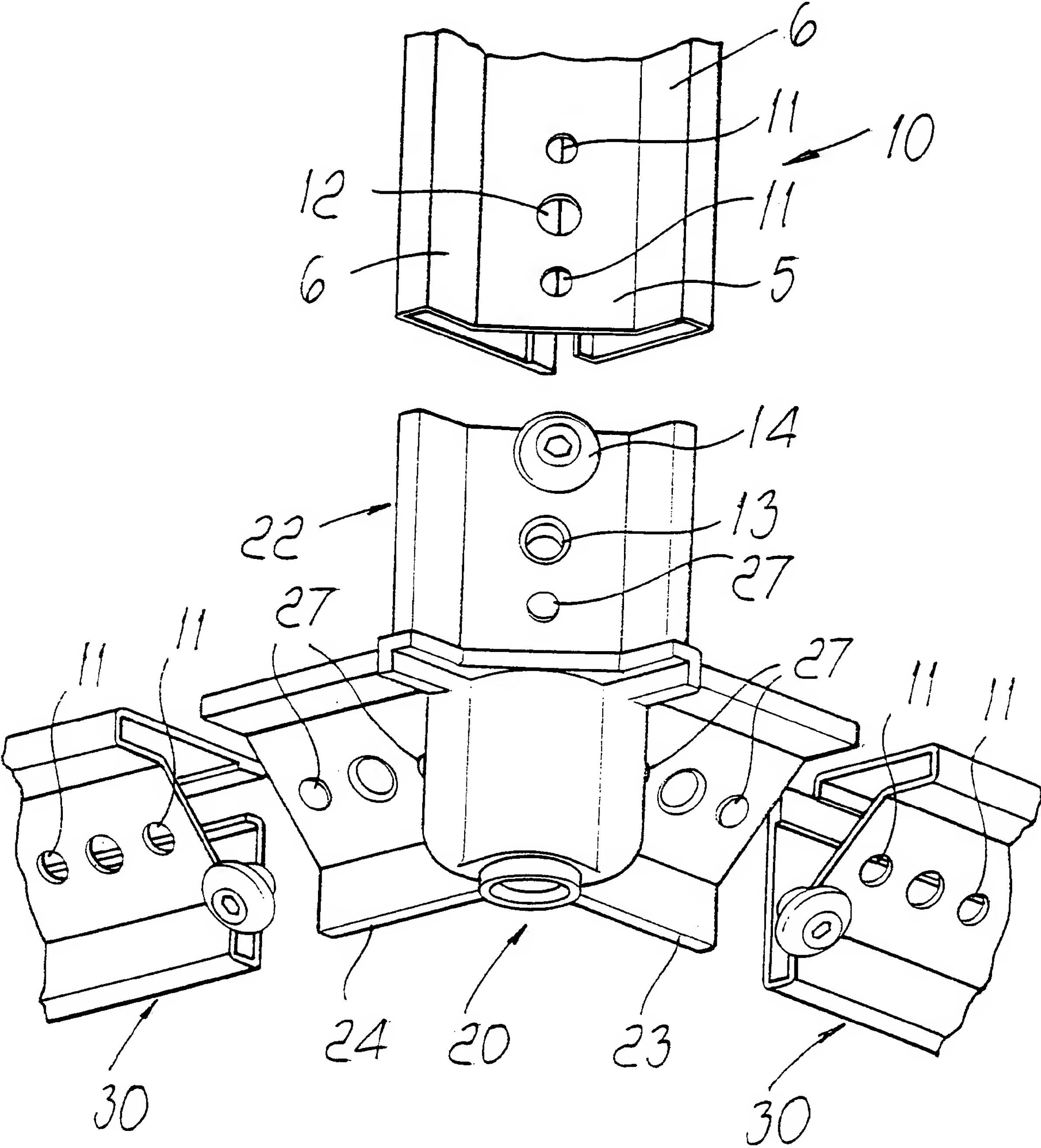


FIG. 2

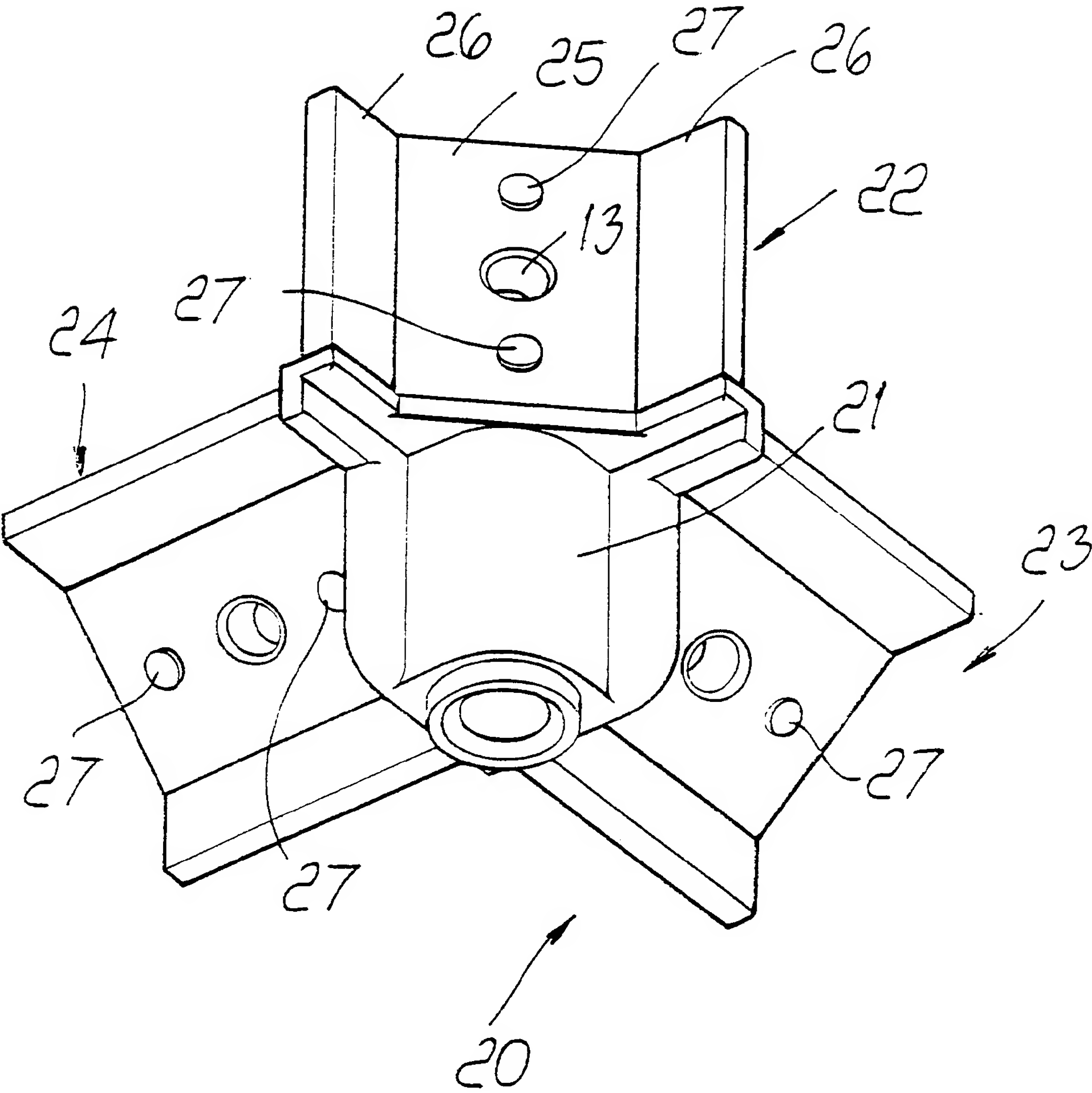
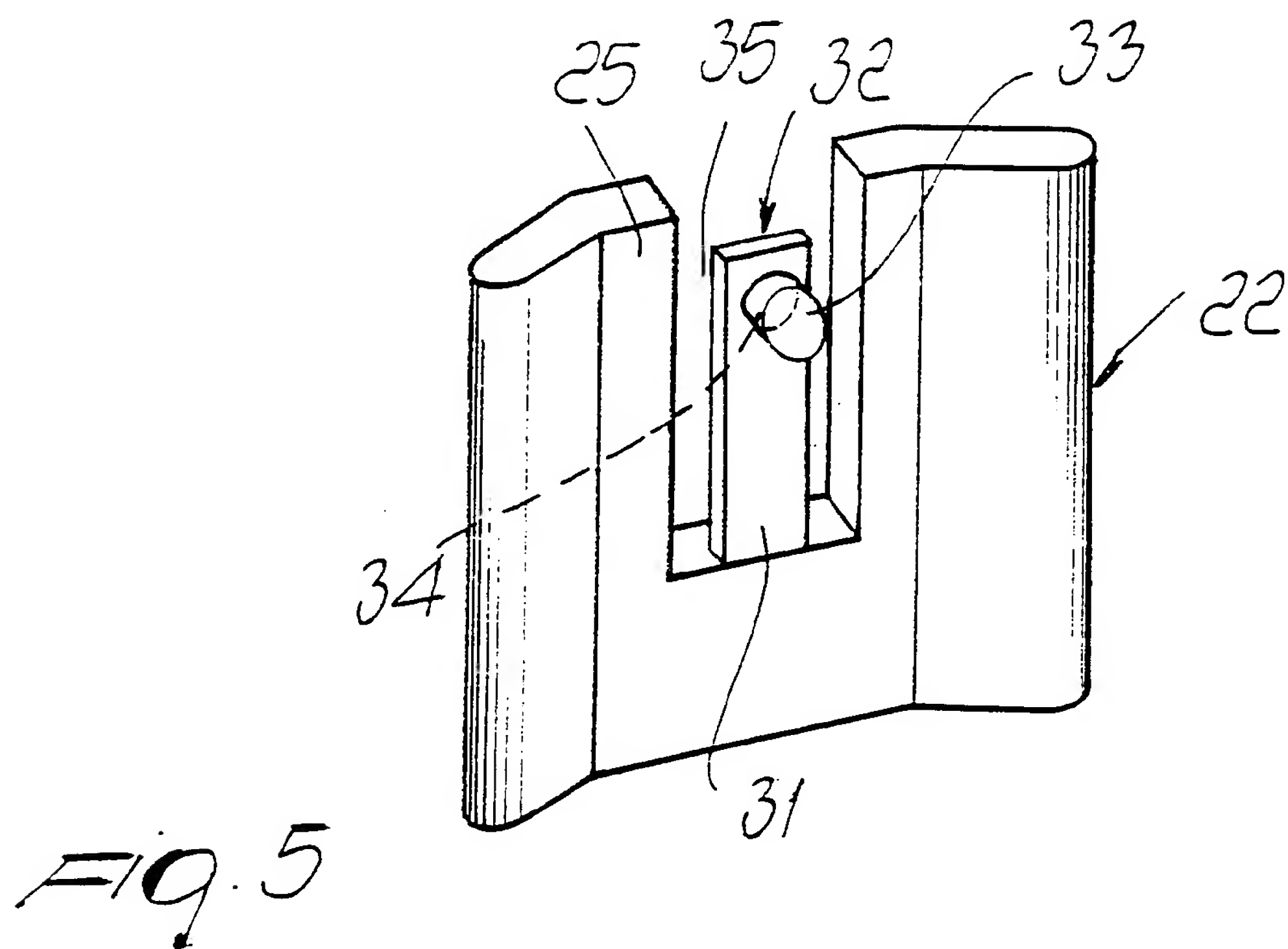
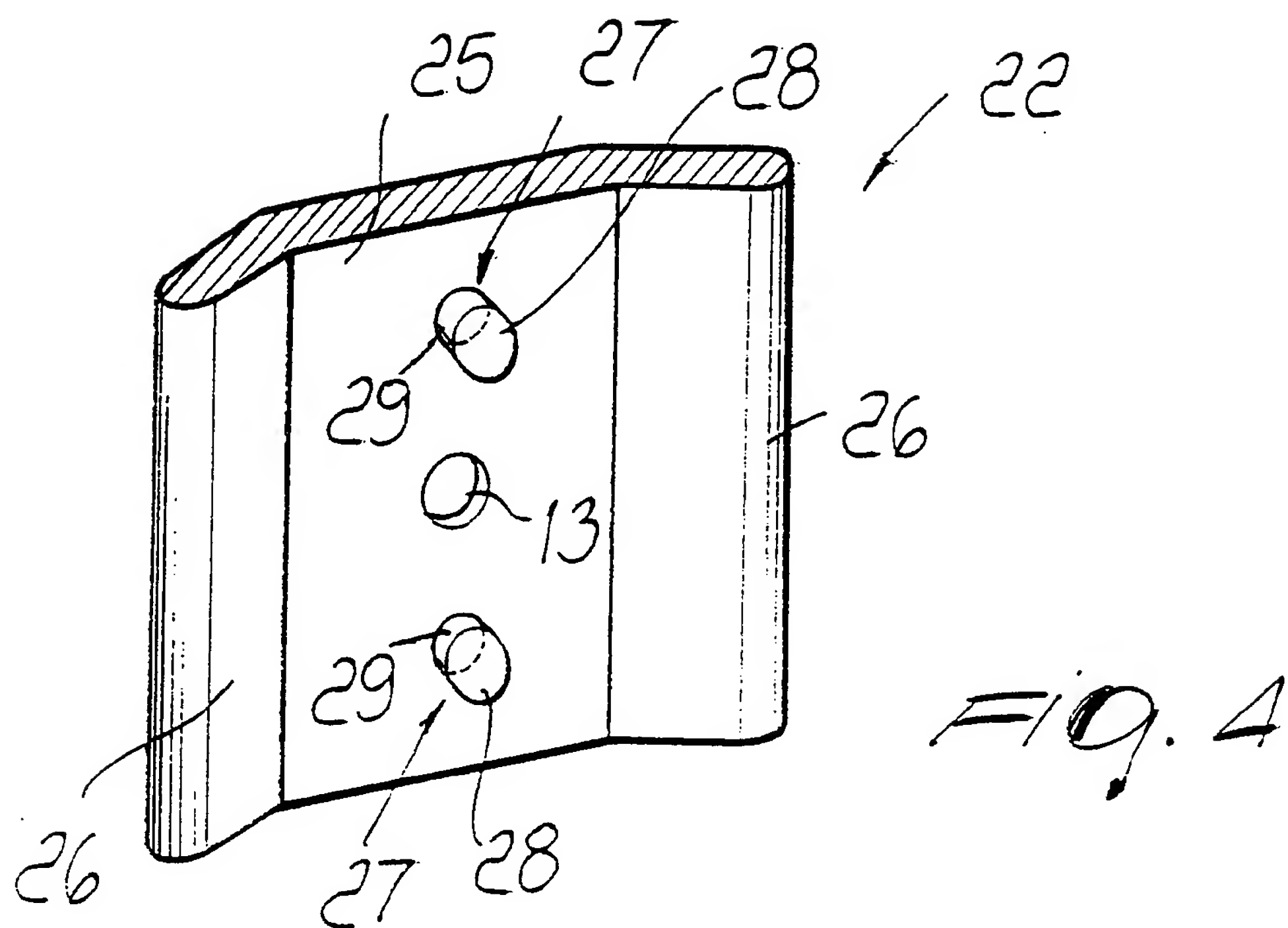


Fig. 3



INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/11243

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H02B1/01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H02B F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 603 628 A (DAY ROBERT L ET AL) 7 September 1971 (1971-09-07)	1
A	abstract column 3, line 4 - line 17 ---	2-5, 10-12
A	DE 85 28 924 U (ANNELIESE MERTES GMBH) 12 December 1985 (1985-12-12) -----	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

14 February 2001

Date of mailing of the international search report

20/02/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Dailloux, C

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. Application No
PCT/EP 00/11243

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3603628 A	07-09-1971	NONE	
DE 8528924 U	12-12-1985	NONE	